1.4 Distinct or Coincident Lines

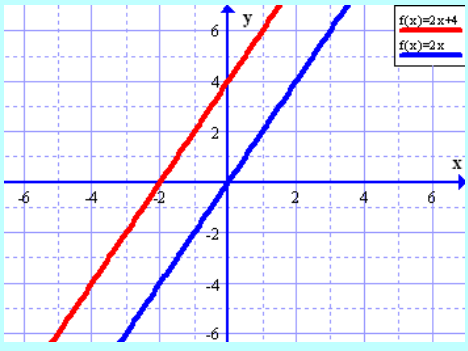
Remember the linear systems that we solved by graphing in our first lesson?

a) $y = 2x + 4$
$y = 2x$

b) $y = 2x + 4$
$y = -x + 4$

c) $y = x - 3$
$4x - 4y = 12$

a) $y = 2x + 4$
$y = 2x$



These lines are parallel and distinct, there was no solution to the system.

What would happen when you solve this system algebraically?

Solve the following linear system using an algebraic method.

$y = 2x + 4$ ①
$y = 2x$ ②

Substitution

$2x = 2x + 4$

$2x - 2x = 4$

$0x = 4$

$\frac{0x}{0} = \frac{4}{0}$

$x =$ error (not true)

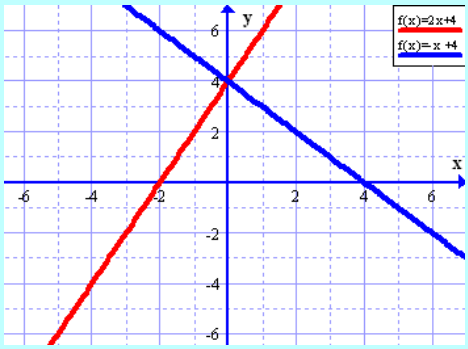
★ no solution

lines are distinct

Elimination

$y = 2x + 4$
$-\ y = 2x$
$0y = 0x + 4$

b) $y = 2x + 4$
$y = -x + 4$



These lines are not parallel, there was **one** solution to the system.

What would happen when you solve this system algebraically?

Solve the following linear system using an algebraic method.

$y = 2x + 4$ ①
$y = -x + 4$ ②

Sub ① into ②

$2x + 4 = -x + 4$

$2x + x = 4 - 4$

$\frac{3x}{3} = \frac{0}{3}$

$x = 0$

Sub $x = 0$ into ①

$y = 2x + 4$

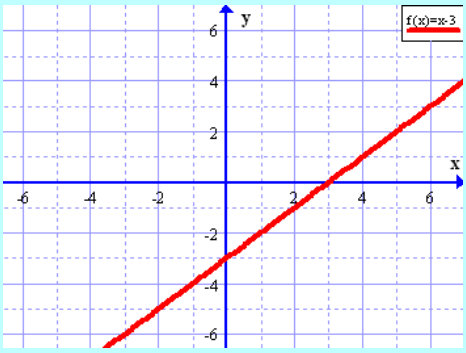
$y = 2(0) + 4$

$y = 4$

∴ the POI is $(0, 4)$

c) $y = x - 3$
$4x - 4y = 12$

happens at the same time



These lines are the same (coincident), there were **infinitely many** solutions to the system.

What would happen when you solve this system algebraically?

Solve the following linear system using an algebraic method.

① $y = x - 3$

② $4x - 4y = 12$

Sub ① into ②

$4x - 4y = 12$

$4x - 4(x - 3) = 12$

$4x - 4x + 12 = 12$

$4x - 4x = 12 - 12$

$0x = 0$ always true

Coincident

When solving a linear system algebraically:

Exactly One Solution:
- you can find the value of one of the variables and then solve for the other.

No Solution:
- you end up with an untrue statement.

e.g. 0x = 2 is never true
- these lines are distinct.

Infinitely Many Solutions:
- you end up with a statement which is true for any value of x.
- 0x = 0 is always true
- these lines are coincident.

Assigned Work: p. 59 # 1, 2a, 3abcfh, 4, 6*